Example name: *Solar Heating & Cooling fed through an Solar Thermal Building Integrated Facade*

Template completed by:
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For installations

BISTS Location:
Catania, Italy

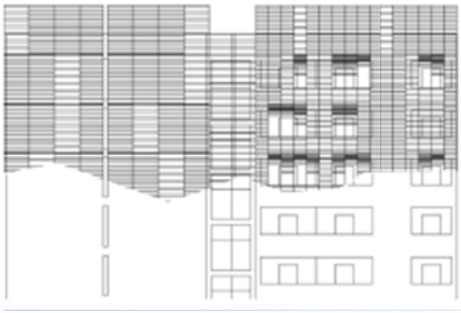
Climate Type:
Köppen Csa

Building Use:
Residential High-Rise

Level of BISTS integration:
Reijenga classification: 3

Type of activity:
****Proposal for refurbishing a high-rise residential building to include active solar heating and cooling supplied by a façade integrated solar thermal concentrated system***

Photographs



The "Concrete building" in Catania: current façade (lower part) and simulation of the new proposed solar thermal coating (upper part)

Source: Caponetto, R., Caponetto, R., Cecere, C., Culla, A., D'Urso, S., Habib, E., Margani, G., Sapienza .V. *"Active Building Envelopes - An integrated solution for solar cooling and heating".* PLEA2013 - 29th Conference, Sustainable Architecture for a Renewable Future, Munich, Germany 10-12 September 2013

Type of BISTS:

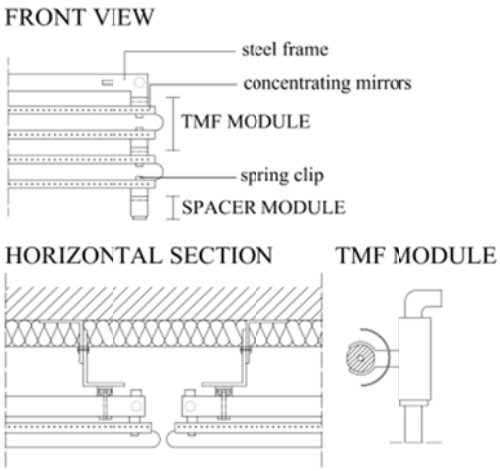
Active System

Function(s):
Space Heating & Cooling
Linked with other system – absorption chiller

Building element:

Façade

Drawings/Sketches/Cross-sections



Design of a panel made by Tube-Mirror Frame module

Source: Caponetto, R., Caponetto, R., Cecere, C., Culla, A., D'Urso, S., Habib, E., Margani, G., Sapienza .V. *"Active Building Envelopes - An integrated solution for solar cooling and heating".* PLEA2013 - 29th Conference, Sustainable Architecture for a Renewable Future, Munich, Germany 10-12 September 2013

BISTS characteristics:

"In this study an innovative solar thermal façade has been designed for an existing apartment tower in order to satisfy the energy needs for winter heating and summer cooling. The tower, built in the 80s, is located in Sicily, a region representative of a mild Mediterranean climate. The proposed system consists of evacuated tube solar collectors assembled on modular panels. Also the aesthetic instances have been properly considered, taking care of both the design and the composition of the panels on the façade."

"The main component of the designed system is a modular panel, consisting of a steel frame, supporting evacuated tube solar collectors along with their mirrors. The panel is realized starting from a preassembled basic module. This basic module, called TMF (Tube-Mirror-Frame), consists of an evacuated tube and its mirror, both connected on two sections of the steel frame. The TMF modules are stackable through a plug-in system and joined together with the upper and lower beam of the steel frame. To collect the solar energy impinging between tubes, aluminium mirrors are used, in order to focus solar rays onto the tubes. This setup allows reaching stagnation temperatures well over 300°C, and operating temperatures about 120°C without significant efficiency loss, thus useful for absorption chiller operation."

"The active portion of the outer envelope described is set to be 490 m^2 on each of the almost windowless East and West façades, and 450 m^2 on the South façade. Mean temperature of the fluid in the solar panels is set to 100°C for heat loss factor evaluation."

"COP of absorption chiller together with hydraulic systems is set to 0.6."

Source: Caponetto, R., Caponetto, R., Cecere, C., Culla, A., D'Urso, S., Habib, E., Margani, G., Sapienza .V. *"Active Building Envelopes - An integrated solution for solar cooling and heating".* PLEA2013 - 29th Conference, Sustainable Architecture for a Renewable Future, Munich, Germany 10-12 September 2013

Stage of Development:	**Responsible:**
***Idea/Proposal**	***University of Rome*** ***University of Catania***

BISTS description and context

Project motivation: *Building refurbishment towards style retrofitting, a desire for low energy consumption and willingness to experiment with new ideas related to building integrated solar thermal*

System viability

Economic analysis not available.

Modelling and simulation tools developed/used

Modelling tools used in the analysis not available.

BISTS Performance data

Based on:
Detailed simulation

Performance parameters

For integrated systems:
key performance indicators -

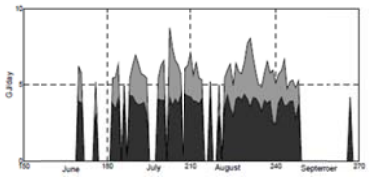
Solar savings fraction: %
Light transmittance: %
Solar transmittance: %
Total solar energy transmittance: %:
Solar heat gain factor: %
Building fabric U-values: W/m^{2}K
Noise, fire, etc ratings
Other:

For separate collectors:
performance rating coefficients -
(EN12975, a0,a1,a2), ASHRAE, etc

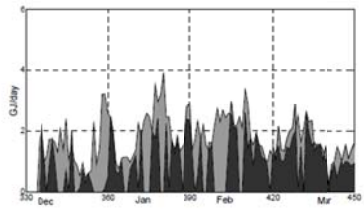
Other:

Graphs for collector efficiency, seasonal energy gains, diurnal/seasonal solar fraction, etc.

"With the parameters set for the specific building, the model shows that the proposed solar system can fulfil about 26% of heating demand and 69% of cooling demand, without considering any effect on the heat transfer performance of the new envelope. Evaluating the loads reduction due to the insulation of the building envelope and the shading on both windows and walls, 69% of the original heating energy demand is fulfilled by solar heating while up to 95% of cooling demand could be ensured by solar cooling."



Cooling load (light-grey) and solar cooling (dark-grey)



Heating load (light-grey) and solar heating (dark-grey)

Source: Caponetto, R., Caponetto, R., Cecere, C., Culla, A., D'Urso, S., Habib, E., Margani, G., Sapienza .V. *"Active Building Envelopes - An integrated solution for solar cooling and heating".* PLEA2013 - 29th Conference, Sustainable Architecture for a Renewable Future, Munich, Germany 10-12 September 2013

Additional information:

Sources and references:

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